

# DRAFT TRIAL DIRECTIVES IN RESPECT OF ALL PURPOSE HIGH INTENSITY VEHICLE

Date of Trial	Temperature
Time of Trial	Altitude
Place Of Trial	Weather Conditions
GR of Trial Area	(Clear/Cloudy/Partially Cloudy/Hot and Humid/Foggy and Humid/Rainy)

## **AIM.**

To frame the trial directives for **All Purpose High Intensity Vehicle (APHIV)** so as to facilitate the Mechanical, Physical, Ballistic blast inspection of the APHIV prototype/tender sample.

## **COMPOSITION OF THE TRIAL**

The trial will be conducted on the basis of :-

- a) Physical and mechanical specifications. :-Appendix A
- b) Protection standard Specifications :-Appendix B

No part or accessories of the APHIV will be replaced /changed once the trial procedure commences.

## **GENERAL REQUIREMENTS.**

Following men and material should be available during the trial procedure.

1. At least one APHIV with all accessories as the QRs along with 2 drivers.
2. One heavy recovery vehicle with ability to lift the APHIV.
3. Loose soil/material/slippery surface as per requirement.
4. Measurement tools/instruments (Measuring Tape/SWG, Meter Scale/Vernier Caliper, Compass or other device for angular measurements etc).
5. Sufficient Open Ground.
6. Company Rep to give Presentation/Demo of operation of APHIV as per physical and operational specifications.
7. Computer with printer.
8. Calculator.
9. Sufficient Stationary.
10. White chalk for marking the centre of the track of tyres during calculation of turning radius.
11. Sufficient manpower.
12. Stop watch
13. Video camera and still camera to obtain pictures/photos for stage-wise trial.
14. Any other material/instruments or anything else as per requirement.

## APPENDIX:-A

### DRAFT TRIAL DIRECTIVES FOR THE PHYSICAL AND MECHANICAL SPECIFICATIONS OF THE APHIV

SNo	Criteria	Testing procedure	Desired Result
1	Protection Standard	Ref Appendix B	
2	Payload	Pay Load capacity should be checked by loading the vehicle with the weight of 1000kg (totally equipped 10 soldiers along with their luggage and other combat related accessories)	The veh should be able to carry the minimum payload of 1000kg without having any effect on the manoeuvrability and related performance parameters
3	Seating Capacity	It should be checked physically by all 6 passengers sitting inside. Driver and co driver seat should be checked by adjusting them along longitudinal axis of the vehicle and also for inclination.	The passengers should be able to accommodate comfortably and safely.
4	Engine	To be checked as per the certification	The veh should be able to meet the QR.
5	Power to weight Ratio	The documentation should be checked as per the certification by ARAI/VRDE . For checking the shift of the fly mechanism from 4x2 to 4x4 transmission mode the engine shifting will be done while the vehicle is on the move.	The veh should be able to meet the QR.
6	Air Conditioning	It should be checked by the BOOs by taking test drive of the vehicle in a Hot cum Humid as well as Cold Climatic condition while all 6 passengers are sitting in the vehicle.	HVAC should be able to meet the desired temperature level inside the crew compartment.
7	Mobility	The transmission of the veh to be checked physically &mechanically by engaging the 4x4 gear and driving it in 4x4 mode	The vehicle should be having 4x4 wheel drive and should run smoothly in 4x4 operation.
8	Length	It should be measured by measuring tape	The veh should be able to meet the QR.
9	Width		
10	Ground Clearance		
11	Speed	It should be measured by test driving the vehicle with full battle load at an appropriate testing range or some other suitable place.	The veh with full load should be able to attain max speed pf at least 110km on battle load
12	Fording Capability(Crossing Water Filled Area)	To be physically checked by using driving the vehicle through a water body of minimum 800mm na dafter preparing the vehicle as per the manual 1200mm.	The veh should be able to meet the QR.
13	Straight Edge Step	To be physically checked by using	The veh should be able to

		driving the vehicle through a straight Edge step of height of minimum 400mm	meet the QR.
14	Straight Edge Ditch	To be physically checked by using driving the vehicle through a straight Edge Ditch of minimum 7600mm.	The veh should be able to meet the QR.
15	Gradient Negotiating	The veh should be checked by climbing on test trucks at VRDE or similar tracks as per the procedure adopted by VRDE	The veh should be able to meet the QR.
16	Side Slope		
17	Range	The veh should be tested by driving required range of operation as specified	The veh should be able to meet the QR.
18	Cold Start	To be mechanically checked by the BOO by using artificial means.	The veh should be able to meet the QR.
19	Transmission	This specification will be checked as per certification by the ARAI/VRDE.	The veh should be able to meet the QR.
20	Run flat tyre system	The be physically checked by the BOO by driving the vehicle with flat tyres up to the required distance at cruise speed.	The veh should be able to meet the QR.
21	Driving	To be physically checked by running and steering the AIPHV in different types of terrain.	The driver should be able to drive the veh in different types of terrain comfortably
22	Turning Radius	It should be checked by taking test drive of the APHIV. On a standard test track the veh should be made to stand in fully steered /turned position (say right), a thick marking of white chalk should be applied over the centre of the road of the front outside tyre and the APHIV should be made to move slowly and gradually chalk marking should be kept on applying continuously along the centre of the tread of the tyre of APHIV so that it leaves clear circular path on the ground covered by the front outside tyre. Turning radius should be measured simultaneously w.r.t the outer most point of the vehicle.	The veh should be able to meet the QR.
23	Self Recovery	To be physically measured by using a measuring tape and the hooking up the recovery rope to a fixed point or tree and checking the vehicle to recover itself while it is switched off.	The veh should be able to meet the QR.
24	Types of fuel	To be checked as per the certification.	The veh should be able to meet the QR.
25	Emission norms	The certification to be checked as	The vehicle should be able to

		per the CMVR norms.	meet the QR.
26	Operating temp	To be physically check by taking a test drive.	The vehicle should be able to operate in the temp specified in the QR
27	Firing port	As described in the QR	The vehicle should be able to meet the QR.
28	Wind shield and side glasses		
i)	Windshield and window glasses	As described in the QR	The vehicle should be able to meet the QR.
ii)	Side glasses	As described in the QR	The vehicle should be able to meet the QR.
iii)	Rear window glasses	As described in the QR	The vehicle should be able to meet the QR.
29	Steering	The BOO should physically check the orientation of steering system.	The vehicle should be able to meet the QR.
30	Auto defrost	It should be checked by starting the vehicle . before that it should be ensured that mist formation has taken place inside the windscreen of the vehicle . it the climatic condition is not supportive of mist formation the same should be created artificially with the help of putting hot water in large pots .	It should be able to start defrosting the vehicle glass panes automatically as per the QR.
31	Lubrication	The certification of the vehicle should be checked as well as all the test drives should be done using the lubricants as per the QR	The veh should run without any fault during the entire test drives.
32	Engineer support	All the documents should be checked by the BOO.	The veh should be able to meet the QR.
33	Radio interference	It should be checked by initiating a radio call from inside the running vehicle and the output checked a static location within the range of the radio set.	The veh should be able to meet the QR.
34	MISC		
	a) Multi entry and exit from rear and sides	To be physically checked by the BOO	The veh should be able to meet the QR.
	b) High intensity beam head light	The vehicle should be checked by driving in night with head lights switched on.	The driver should be able to drive comfortably.
	c) Lighting system- additional blackout lights, search lights 360 deg rotating, Flash lights, Fog	To be checked physically and mechanically	The veh should be able to meet the QR.

	lamps to be provided		
	d) Logistic support package to include repair manual ,illustrated spare parts package, operation & maintenance manual.	All the related literature and other documents / manuals/spare parts etc should be checked physically.	The veh should be able to meet the QR.
	e) First aid box	It should be checked physically.	
	f) Spare wheel to be provided	It should be checked physically.	The veh should be able to meet the QR.
	g) Suitable camera system for rear and side view to be provided	It should be checked physically by driving the vehicle during day and night with and without the headlights on	The driver must be able to easily reverse only with the help of Rear View camera , side view mirror should have sufficient dimension and should be auto adjustable.
	h) Compatible Tow hooks to be provided.	It should be checked physically and by pulling the other vehicle of similar class and getting pulled by another vehicle of similar of higher class	The veh should be able to meet the QR.

## DRAFT TRIAL DIRECTIVES FOR THE PROTECTION STANDARD SPECIFICATIONS OF APHIV

1. For proper understanding of the Trial Directives, they must be read in conjunction with the QRs as many concepts have already been explained there and to avoid repetition the same are not being mentioned here. The detailed trial directives describes the acceptance criteria and test procedure for determining the protection levels of APHIV against IED blast of the type we are most likely to face in tactical situ and threats rendered bt small arms (except armor piercing(AP) rounds).OEM/supplier of the APHIV may give two sample vehicles for testing by us for checking its maneuverability performance ballistic as well as blast testing i.e side –IED blast testing and designated quantities of TNTs underneath. The test may be done in the presence of their authorized rep. Alternatively the vehicle may also be subjected to some of the tests at their location by the Board of Officers such as checking some of the automotive/mechanical parameters, raw material, stage sampling and cutting etc.

2. **PHOTOGRAPHS & VIDEO RECORDING :** Photography & video recording of the trial test will be made. Video recording would form a permanent record of the proof of the claims made by the company and for the record of the organization representing Govt. of India/MHA involved in the testing process.

3. **COMPOSITION OF VARIOUS STEPS OF THE TRIAL:** The trial will be conducted in following steps:

- a) Test on Prototype/sample vehicles for tender Sampling during technical evaluation of bids.
- b) Raw Material Stage Sampling and Ballistic testing(Wherever required).
- c) Sampling and Ballistic testing of Vehicles in Body-In-White(BIW)Stage including IED Blast Testing.
- d) Final Inspection.
- e) Pre-Dispatch Inspection(PDI)/Joint Receipt Inspection(JRI).

*Note:- In Order to carryout the above test/trials wherever required the services of Govt Laboratories etc will be taken and their representatives will be associated.*

## PROCEDURE

### 4. **TEST PROCEDURE ON PROTOTYPE VEHICLES FOR TENDER SAMPLING**

#### a) **GENERAL:-**

- i). Manufacturer/fabricator/supplier should submit complete details of the modification carried out in the base vehicle. If any along with details of sources of supply of all blast/bullet resistant component/materials used for modification and their test certifications.
- ii). At all the places of welding in the armor, they should be protected with back up amour plates of sufficient dimensions to avoid any ballistic /blast gaps.
- iii). The manufacturer/ fabricator of the vehicle shall use only that adhesive which has been prescribed/ approved by the original manufacturer of the IED & Bullet Resistant Glass and the same shall be covered under the warranty.

- iv). The base vehicle warranty , if any should be extended to APHIV veh also. The certificate to this effect is to be provided by the veh manufacturer cum supplier along with each vehicle. If no specific base vehicle is used and APHIV on monocoque hull is manufactured by using different aggregates such as axles, propeller shaft, transmission etc. from different manufacturers than the warranty clause should be as per provisions in QRs. In both the cases the warranty of the APHIV should be less than the prescribed in the QRs.
  - v). Three years warranty fro IED &Bullet Resistant Glass should be provided(irrespective of warranty for the vehicle) in respect of transparency, lamination, air bubbles and all aspects (except IED &Bullet Resistant properties) mentioned in the quality plan required to be submitted by the manufacturer-cum-supplier of the APHI. For IED & Bullet Resistant properties, the warranty should be five years.
  - vi). The IED protected vehicle should withstand the shower test.
- b) **TEST ON PROTOTYPE:-** The manufacturer /fabricator will submit 02 (two) sample vehicles at NO COST NO COMMITMENT basis for running and destructive testing (ballistic/ blast testing) till it passes, all the test details mentioned below. The prototype pc vehicle will be evaluated by Board of Officers (BOO) in accordance with the following steps;
- i) **CONSTITUTION OF BOARD OF OFFICERS:** A BOO will be constituted with minimum 5 (five ) officers to test the prototype vehicle.
  - ii) **PHYSICAL INSPECTION:** the prototype vehicle will be inspected for any ballistic gap / deficiency. Before commencement of the physical inspection of the tender sample the Board will ensure that IED & Bullet Resistant material used in IED Protected Vehicle must have been previously tested and certified as per criteria mentioned in various clauses of these trial directives. The Original Equipment Manufacturer (OEMs) fabricator will make available al the time of inspection armoring process and submit control plan to BOO. It will include following aspects:
    - a) IED & Bullet Resistant Plate thickness at various places.
    - b) Welding electrodes used.
    - c) Welding process and the type of welding / joining process & the type of the joining.
    - d) Method ol cutting / joining the IED & Bullet Resistant Plates and control of heal generation during this process so as to ensure that no major deviation in the IED & Bullet Resistant properties of the IED & Bullet resistant plates took place.

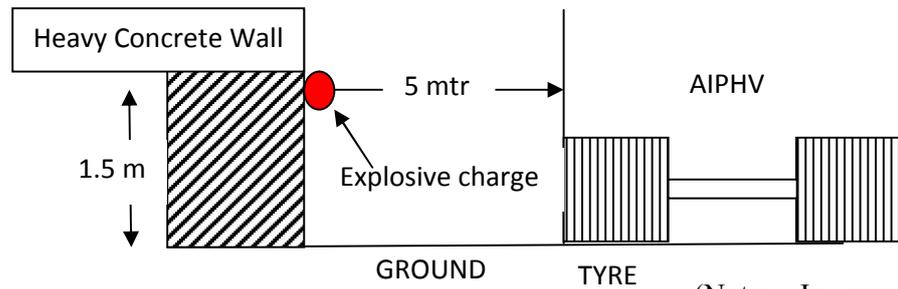
Further, OEMs/fabricator will make available at the time of inspection armoring process and control plan at each stage of armoring process like Tail gate, Door front(if any). Door rear, firing ports, other cuttings. Vehicle outer body and vehicle under belly. This will have detailed description of part number ol'IED & Bullet Resistant Plate used.

- iii) **DRIVING TEST OF THE VEHICLE :** Various parameters as mentioned in the QRs including braking efficiency, maneuverability, passenger comfort, driving comfort and turning radius as per the vehicle

specifications will be tested by driving the vehicle for 2000 km (700 hilly + 1300 in plain, marshy, cross-country terrains). The cost of testing will be borne by manufacturer /supplier of the vehicle. The modifications carried out to brakes, suspension, axles, transmissions and steering are to be carried by the Original Equipment Manufacturer (OEMs) of the vehicle / or through the joint venture of OEMs of fabrication of APHIV.

iv) **DESTRUCTIVE TESTING BY BOO:**

- a) The APHIV is a costly piece of equipment, The user cannot accept merely a claim made by the manufacturer/supplier or some certificate produced by them from whichever laboratory (government or private in any country) that the vehicle meets NSG's requirements in terms of maneuverability and the protection offered under the threats that have been discussed in detail in QRs. The user has to evaluate the MPV in a scientifically valid and transparent manner. Moreover, the proof of the vehicle meeting our requirements must be in the form of a permanent record for future verification at any time.
- b) The indenter will arrange all firearms, ammunitions / explosives required for conducting the above tests. The trial tests would be conducted exactly in accordance with the parameters defined in the QRs above. That is:
  - i). The vehicle shall be subjected to a blast of TNT or equivalent in the following manner. The integrity of the monocoque hull should not be compromised (that is. it should not be breached / broken) by the blast of 6 kg of TNT buried in a commercially available storage container of cylindrical shape made of 3 mm thick stainless steel . There should be an earth cover (loose soil) of 2 feet over and above the top surface of the explosive container. Container with its material specification will remain exactly same for all the blast tests and the required quantity of cylindrical explosive charge will be casted in the container.
  - ii). Same conditions as above but with 8kg of TNT under any one of the tires.
  - iii). That the vehicle should have a side-blast protection as demonstrated by its being able to withstand a blast of 10 kg of TNT from a distance of 3 meters at a height of 1.5 m placed by a heavy concrete wall to enable good reflection of blast wave. The charge will have additional 1 kg shrapnel consisting of diverse metal objects like ball bearings, nuts and bolts etc. to simulate real life scenario. The shrapnel will be placed in front of the explosive charge towards the vehicle.



(Note:- In case of

non availability of heavy concrete wall, the vehicle will be loaded by the same blast load generated by detonation of 10 kg TNT charge kept in configuration as shown above. Equivalent explosive quantity and standoff will be decided by TBRL.)

- iv). That even as monocoque hull remains intact under the blasts of the TNT explosives under the hull the shock which transmitted through the floor of the vehicle via the feet and the base of the spine, should, by itself, not be enough to inflict fatal or crippling injuries on the man sitting inside. In addition to the other parameters such as, pressure, temperature, acceleration etc. (which will be measured before/ during / after the blast, as mentioned at various paras below) the deformation of the floor of the AIPHV and vertical compression of the complete seat assembly will also be measured so as to form an index of quality of the interiors and survivability of troops. Use of crash test dummies / mannequins will be resorted to depending upon the availability of such facilities in Govt, approved testing laboratories such as TBRL etc.
- v). That the doors / hatches of the vehicle neither open nor jam under the impact of the blast of the TNT underneath or when it topples to its side due to any other reason not associated with any explosive threat, such as falling in a ditch.
- vi). Additional testing as described in the QRs for checking the strength and design of the front wind screen assembly and fire wall will also be done by placing 6 kg of TNT or equivalent under the engine compartment or from axle area (slightly offset from the front differential towards the rear so that differential or axle housing do not impede the flow of blast or any one of the front tyre . After the blast it will be checked if any of the engine parts/metal

aggregates or anything below or above the bonnet sufficient enough to inflict any kind of injury to the human body has smashed into crew compartment through the front wind screen, fire wall or through the floor. In such a case the APHIV will be rendered fail.

vii). The sequence of test will be as follows: side blast; TNT blast under the hull; TNT blast under any one of the tires. Out of the two TNT blasts (i.e. under the tire and hull) any one will be done on a single MPV. As the vehicle aggregates and other major components are likely to suffer extensive damage during the side blast and the blast of TNT under the hull/Tyre, in all likelihood the second sample vehicle will be required for carrying out remaining TNT blast as mentioned above. This requirement has been mentioned in previous paras also.

viii). The vehicle (that is its body consisting of metal / composite material plus IED & Bullet Resistant glasses) should provide protection to the personnel inside against all small arms fire including 7.62x54RB32 API Dragnov mm cartridge bullets from all sides including the top when fired from a distance of 30m at 90 degrees angle of incidence for side walls and at an angle of 45 degrees for the top. At least 06 (six) bullets each will be fired on each side and top of vehicle body consisting of metal composite material and three bullets each on any two panels of IED & Bullet Resistant glass used in the vehicle.

The cartridges used will be standard OFB cartridges manufactured in these calibers in the present or in the past. In case of 7.62 x 54mm API imported ammunition (steel core) will may be used. In case the same cannot be imported well in time, best available corresponding OFB made ammunitions will be used.

**c) VEHICLE CONFIGURATION BEFORE TEST BLAST TEST:-**

i). Prior to the blast, the vehicle shall be loaded with as many sand bags of 40kg each /suitable weight to simulate the weight of the troopers (i.e. payload). As weight of APHIV during the blast is very important and sensitive parameter therefore if APHIV is subjected to blast test in BIW/semi furnished stage all efforts should be made to load it with so many numbers of additional sandbags that the total weight

of the APHIV during the blast test actually corresponds to its weight in terms of the full complement of soldiers it is supposed to be carrying at its maximum capacity. It is very pertinent to mention here that sand bags should be so placed/located that they actually work as dead weight only and not as a cushion to the dummies, if they are used at all / measurement gauges during the blast. If no dummies are being used then the sandbags can be placed on the seats itself.

- ii). MPV will undergo blast test under proper inspection as per the documented procedure. For its geometry, maneuverability and major configuration, the vehicle should be complete in all respects before the blast test is under taken.
- iii). The hull and inner as well as outer surface / components of the APHIV should be thoroughly checked and video / photographic (especially at all weld joints / cuttings etc.) before and after the blast trial is one.

**d) ADDITIONAL EVALUATION PARAMETERS AND ACCEPTANCE CRITERIA FOR MINE BLAST TEST:-**

- i). During the blast both inside and outside the hull pressure and temperature should be recorded. For this purpose suitable blast /temperature measuring gauges will be deployed at multiple designated places. From a distance 3.00 meters from explosive charge on both left and right sides at least one gauge on each side should be deployed at a height of 1.00 meters min. Similar manner at least two numbers of blast measuring gauges be deployed inside hull, one near the driver and co drivers place and another at trooper seats. To record the sound of the blast inside the troopers compartment at least two sound level meters also to be deployed for record purpose. Similarly, the temperature rise inside the vehicle due to blast to be recorded by keeping suitable thermocouple. The upward lifting of the vehicle due to the blast to be recorded by deploying accelerometers as well as high speed photography to enable it to be viewed in slow motion later, G value will also be recorded at multiple places. Various evaluation parameters will be recorded as per the “sample” table drawn below:-

S.No	Gauge Loc	Dist from Veh	Temp	Peak over pressure kg/cmsq	Duration on (msec)	Impulse kgmsec /cmsq	Remarks
1	G1(LHS)						
2	G2(RHS)						
3	G3(TROOP)						
4	G4(DRIVER)						

- ii). The guiding principle of the above tests is that, even if the integrity of the hull is not compromised, fatal injuries should not be inflicted on the troops inside as a result of the blast.
- iii). The BOO shall also take note of the time taken to restore vehicle for running condition by manufacturing factory to be recorded with the list of items replaced.
- e) **RUN FLAT TYPES:** The vehicle with minimum two tyres punctured must be capable of running 100 km without the tyres coming off the rims or burning and without any adverse effect on steering, maneuverability, stability nad braking performance. Of this 03 km must be with its top speed as required in the QRs 22 km with a speed of 50 kmph and 75 km with 25 kmph. The detailed FINABLE standards may be referred to.

Note : -

The above test will be carried out during lender sampling and before the blast test. This test will also be applicable to the randomly selected sample APHIV representing the lot of 100 APHIVS that will be subjected to blast Test only. However, the detailed lest procedure as prescribed below will invariably be adopted for ensuring quality during bulk manufacturing / materialization of supply orders.

5. **ACCEPTANCE CRITERIATO BE USED IN BALLISTIC TESTING WITH BULLETS:-**

- a) **GENERAL.** The veh will be fires as follows:-

Armor Type Level -III	Test Cartridge	Bullet Weight	Reference Velocity m/s	Shots per panel/side
For Steel	7.52 x 51mm Ball NATO FM	9.4 to 9.6 gm	838+15	6
For Composite material	7.52 x 51mm Ball NATO FM + 7.62x39 mm Steel Core	9.4 to 9.6 gm	838+15	3
		+ 7.45 to 8.05 gm	+ Upto 725	3

Armor Type	Test Cartridge	Bullet Weight	Reference Velocity m/s	Shots per panel/side
For Steel and	7.52 x 51mm	9.4 to 9.6 gm	838+15	6

Glass	Ball NATO FM			
For Composite material	7.52 x 51mm Ball NATO FM	9.4 to 9.6 gm	838 $\pm$ 15	3
	+ 7.62x39 mm Steel Core	+ 7.45 to 8.05 gm	+ Upto 725	3

Note-

- i) If the indenter or the BOOs desires to do so they can use 5.56X45 mm ammunition in place of or in combination with 7.62 mm Caliber ammunition as described above. Sufficient reasons must be recorded for doing so by the BOOs.  
The 5.56x45 mm ammunition should have the bullet weight in the range of 4.00 gm to 4.20 gm and reference velocity of 940  $\pm$ 25 m/s.
- ii) In Case of Glass Panels only 3 shots of ammunitions will be fired
  - aa) Bullets from a distance of 10 meters at an angle approximately 90°.
  - ab) the surface in respect of all sides of the vehicle and at an angle approximately 45° to the surface in respect of Roof of the vehicle. Out of six shots fired at a panel, at least two bullets should attain the speeds more than their respective mean velocity (max) c.g. if only 7.62X51 mm ammunition is used, at least 2 bullets with velocity more than 838 m/s (up to 853 m/s) must be resisted.
  - ac) For testing on sample IED & Bullet Resistant steel composite material during raw material stage ballistic testing a test specimen of (300 $\pm$ 5mmX300-t-5mm) size will be subjected to firing. Similarly for testing on IED & Bullet Resistant steel / Composite material during BIW stage an area of (300 $\pm$ 5mmX300 $\pm$ 5mm) on each side of the vehicle body will be marked. However for testing on sample (IED & Bullet resistant glass a piece of (500 $\pm$ 5mmX500 $\pm$ 5mm) size will be subjected to firing.
  - ad) In order to check that proper ballistic overlapping of the vulnerable areas of the vehicle has been done, if the indenter or the BOOs desires to do so, they can select an additional area of (300 $\pm$ 5mmX300 $\pm$ 5mm) at any possibly vulnerable zone c.g. around the B pillar of the vehicle and can conduct angular fire of 03 shots over that area to check if the vehicle design properly caters for angular shot protection, However being a design check this test will only be limited to Prototype/Tender sample only.
  - ae) The firing can be conducted from bolt action/SLR/AK/INSAS.
  - af) Selected weapon and lot of ammunition for which Bullet velocity has been achieved will be considered to remain the same throughout ballistic testing.

b) **ARMOUR PLATE:-**

i). **FAIR HIT RITERIA OF ARMOUR PLATE/SHEET:-**

A bullet that impacts the marked area on the vehicle / test panel at an approximately 90 degree angle, and is at least 51 mm from prior hit or the edge of the test specimen (edge criteria to be considered in case of Raw material stage sampling cum ballistic testing only) and at an acceptable velocity will be called as a fair hit. A bullet that impacts too close to the edge (i.e. less than 51 mm) or a prior hit and / or at too high a velocity, but does not penetrate, shall also be considered a fair hit for determination of non-penetration.

*(Note: - The shot on welded portion may not be "fair hit" but in ground conditions it is likely that bullets may hit the welded portion and it is pierced. In such cases, if the back plate is provided behind the welded portions and stop such shots in a similar way that the back of the vehicle is supposed to do, that such shots will not be treated as penetration.)*

ii) **ARMOUR PLATE ACCEPTANCE CRITERIA:-**When an armor plate does not show significant damage under the impact of the specified bullet it is said that a Standard Resistance has been obtained and the plate is deemed to have withstood the firing i.e. Passed. The actual criteria for evaluation are elaborated below:

Sno	Description of Penetration	Estimation of Penetrative/resistance
1	No Bulging at the back if the armour plate	Passed
	Bulge at back with Radial lines of surface cracks. In doubtful cases apply kerosene oil with brush at the point of impact and test no kerosene oil penetrates to the back of the plate.	Passed
2.	Bulge at the back with radial cracks permitting kerosene oil applied at the point of impact to penetrate through to the back.	Failed
3	Bulging plug outlined at the back plate without penetration but permitting kerosene oil applied at the point of impact to penetrate through to the back	Failed
4	Bulge with tear along the circumference seen at the back of the armor plate	Failed
5	Detachment of chips of any size from the back of armor plate while the bullet has not penetrated the armor plate	Failed.
6	Through shot hole with clean or torn edges or plug knocked out or coming out of the back of the armor plate.	Failed

7	Thorough shot hole with chips of any shape or depth detached from the back if the armor plate in one or more circular layers	Failed
8	Development of cracks in the armor plate extending beyond the area of penetration of bullet.	Failed

**c) ACCEPTANCE CRITERIA FOR IED & BULLET RESISTANCE GLASS**

i). **FAIR HIT:-** A bullet that impacts the armor sample or panel sample or panel at an approximately 90 degree, no closer to the edge of the ballistic panel than 76mm (edge criteria to be considered in case of Raw material stage sampling cum ballistic testing only) and no closer to a prior hit than 120 mm for IED & Bullet Resistant Glass at an impact velocity of the required bullet test velocity will be taken as a fair hit. A bullet that impacts too close to the edge or a prior hit and / or at too high a velocity, but does not penetrate, shall be considered a fair hit for determination of non-penetration.

ii). **PLACEMENT OF THE WITNESS FOIL:-** A witness foil of 0.5 mm thickness or less made of aluminum alloy may be used to evaluate the standard of penetration achieved by IED & Bullet Resistant glass. It shall be rigidly affixed perpendicular to the line of flight of the bullet and 15 cm beyond the glass under test.

When an BR Glass does not show significant damage it is said that Standard Resistance has been obtained and the glass is deemed to have withstood the firing i.e. passed. The actual criteria for evaluation are elaborated below:-

SNo	Description of Penetration	Estimation of Penetration Resistance
1	No perforation of the glazing by the bullet or parts of the bullet	Passed
2	Perforation of the witness foil by the glass splinter from the rear fire	Failed
3	Perforation of the witness foil by glass splinters from protected face	Failed

**6. INSPECTION OF THE VEHICLE(TENDER SAMPLE &BIW BLAST TEST STAGE):-**

Before undertaking the blast trial the following items are essentially fitted and inspected on the IED, Protected Vehicle by the designated inspecting authority.

**a) GENERAL :-**

- i). The engine is tuned up properly and is running smoothly.
- ii). All gauges on instrument / Driver panel are functioning properly.
- iii). Check functioning of bonnet lifting and rear ! side doors / hatches opening / closing through manual procedures or pneumatic actuators.
- iv). Check for proper fitment of towing hook and its related accessories are in place. All brackets, mounting, engine compartments etc. fastened & welded / jointed each other or with the main body to be checked and video /photographed for the purpose.

- v). Check the tyre pressure of all the wheels is up to the required value as mentioned in the technical description.
- vi). Check for proper functioning of wiping system.
- vii). Check for functioning of brake.
- viii). Check the engagement of 4x4 drives in high & low gears for auxiliary gearbox (AGB). Also check differential lock. (May be waived off during BIW stage sample ballistic testing if duly certified by the indenting organization for doing so).

**b) THE FOLLOWING ARE FOLLOWING ON THE VEHICLE BEFORE THE TEST (NOT APPLICABLE FOR PROTOTYPE SAMPLE):-**

- i). The IED protected Vehicle painting and furnishing need not be complete in all respects incl the upholstery.
- ii). New' Spare wheels need not be mounted at the designated places. In its place a dummy wheel or condemn wheel of the same shape, size and weight should be mounted.
- iii). AC system need not be fitted on the vehicle.
- iv). All electrical fittings both inside and outside can be removed like search light an tube light etc but APHIV should be loaded with equivalent addl weight
- v). Vehicle need not be furnished with interior upholstery, however seat frames etc which may form the index of the deformation/damage inside the crew compartment should be fitted.
- vi). Both propeller shafts can be removed (also to be removed during prototype/ tender sample testing).
- vii). Silencer assembly can be removed.
- viii). Rear Axle and Rear tires of the vehicle can be replaced with spare dummy items if available for any one out of the two blasts proposed under hull.

**c) CHECK FOR MEDICAL EMERGENCY: -**

- i). Check the Ambulance and the team of doctors are present on site and stretcher / other accessories are in place.
- ii). Check fire safety instruments / fire Lender are in place and functioning properly.